Canada–U.S. Landing Statistics and Age Composition for Pacific Cod (*Gadus macrocephalus*) from Trawling Grounds Off the Southwest Coast of Vancouver Island, 1956–81

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CANADA-U.S. LANDING STATISTICS AND AGE COMPOSITION FOR PACIFIC COD (*Gadus macrocephalus*) FROM TRAWLING GROUNDS OFF THE SOUTHWEST COAST OF VANCOUVER ISLAND, 1956-81

by

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ABSTRACT

Westrheim, S. J. and R. P. Foucher. 1982. Landing statistics and age composition for Pacific cod (Gadus macrocephalus) from trawling grounds off the southwest coast of Vancouver Island, 1956-81. Can. Data Rep. Fish. Aquat. Sci. 371: iii + 35 p.

Pacific cod landing statistics (Option-2 method) were compiled by representative ground(s) for each quarter-year for the period 1956-81. Corresponding age compositions (numbers landed) were calculated from length-frequency samples of landed cod using a computer method to analyze length frequencies.

Key words: Landing statistics, age composition, Pacific cod, southwest Vancouver Island.

RÉSUMÉ

Westrheim, S. J. and R. P. Foucher. 1982. Landing statistics and age composition for Pacific cod (Gadus macrocephalus) from trawling grounds off the southwest coast of Vancouver Island, 1956-81. Can. Data Rep. Fish. Aquat. Sci. 371: iii + 35 p.

Le présent rapport contient une compilation des statistiques de prises de morues du Pacifique dans les pêcheries représentatives pour chaque trimestre de la période de 1956 à 1981. Les compositions par âge correspondantes (quantité débarquée) ont été calculées à partir d'échantillons des fréquences de longueurs des morues débarquées, à l'aide d'une méthode d'analyse informatisée des fréquences de longueurs.

Mots-clés: statistiques de prises, composition par âge, morue du Pacifique, sud-ouest de l'île Vancouver.

INTRODUCTION

Pacific cod (Gadus macrocephalus) in British Columbia waters are noted for the substantial fluctuations in abundance of individual year-classes, and the concomitant fluctuations in trawl landings. A study is underway at the Pacific Biological Station (Nanaimo, British Columbia) to determine if fishing is a factor in these fluctuations, and to develop a method for predicting the fluctuations in abundance.

The first step in this study is to assemble "data packages" consisting of time series of landing statistics and age compositions for each major region of cod abundance. The first such "data package", for Hecate Strait (International Areas 5C and 5D) (Fig. 1) was reported in Stocker (1981) for landing statistics and in Foucher and Jacobs (1981) for age compositions.

This report contains the second such "data package", for the region lying off the southwest coast of Vancouver Island (Area 3C) (Fig. 1).

MATERIALS AND METHODS

LANDING STATISTICS

Compilation and analysis of landing statistics for the Canada-U.S. trawl fishery in International Area 3C (southwest coast of Vancouver Island, Fig. 1) are complicated by the heterogeneous fishery itself and international developments, which began in 1977. As a result, the Option-2 method developed for the mixed Pacific cod-flatfish fishery in Hecate Strait (Areas 5C and 5D), and briefly described in Stocker (1981), was modified. Details are provided later in this section.

In Area 3C, the Canada-U.S. trawl fishery was heterogeneous with respect to species sought and areas fished. Both national fleets trawled for Pacific cod, lingcod (Ophiodon elongatus), and petrale sole (Eopsetta jordani) on the continental shelf, but only U.S. vessels trawled in the southern one-third of Area 3C--Washington Department of Fisheries Minor Statistical Area 13. The U.S. fleet was also the sole participant in the winter fishery for spawning petrale sole on the continental slope. One Canadian trawling ground (Clo-oose) lies inside the Canadian 3-mile limit, and hence was not available to U.S. vessels. The Pacific ocean perch (Sebastes alutus)/other rockfish (Sebastes sp.) fishery on the outer continental shelf and upper continental slope was not participated in appreciably by the Canadian trawl fleet until 1980. Thus the conventional extrapolation ratio (Canada-U.S. all-species total landings ÷ Canadian all-species interviewed landings) could not be employed to estimate Canada-U.S. all-species total effort, because the estimates would be too large.

In 1977, Canada and the United States promulgated 200-mile economic zones off their respective coastlines and proceeded to negotiate fisheries agreements to control foreign fisheries. The southern provisional boundary between the two economic zones in the Pacific Ocean passes through Area 3C near the northern boundary of Washington Department of Fisheries Minor Statistical Area 13 (Fig. 2). Canadian trawlers were excluded from the U.S. 200-mile economic zone in 1977. U.S. vessels were excluded from the Canadian 200-mile economic zone more gradually, due to negotiations with respect to the Canada-U.S. halibut fishery. As a result, phaseout of U.S. vessels from the Canadian zone began April 1, 1979, when U.S. vessels were restricted to trawling in Areas 3C, 3D, 5A and 5B; and to targetting, under quota, on rockfish only, with a small allowance for incidental catch of all other species. This phaseout terminated in March 31, 1981, and thereafter U.S. trawlers were excluded from the Canadian 200-mile economic zone. For practical purposes, the U.S. trawl fishery for Pacific cod, and allied species, in the Canadian portion of 3C (hereafter referred to as 3C-N) was terminated on January 31, 1979. Area 3C-N was closed to trawling during February 1-March 31 to ensure successful spawning of Pacific cod during a period of cyclic low abundance.

Materials

Canada-U.S. landings of trawl-caught groundfish, by species, month, and international area are published annually in the Groundfish Section of the PMFC[1] Data Series. This series began with the 1956 landings, and is continuing. Canadian total landings, by species, month, international area, and Canadian Minor Statistical Area have been published in various Canadian data series. This series began with the 1945 landings (Thomson and Yates 1960, 1961), and is continuing. The latest, for 1981, is in Leaman (1982), Canadian interviewed landings, by species, are provided in considerable detail from computer tapes at the Pacific Biological Station (Nanaimo, B.C.). Details for each Canadian trawling trip relevant to this study include catch locality (fishing ground), a sub-division of minor statistical area; effort (h) expended; depth range (fath) trawled; weight of each species caught and retained for sale; and month of landing. Canadian interviewed landings were rarely less than 70% of Canadian total landings in any year. Washington State[2] (U.S.) landings, by species, month, international area, and minor statistical area are published in Washington Department of Fisheries (WDF) Data Series. This series began with the 1963 landings (Pattie 1973), and is continuing. The latest published report contains the 1979 landings (Pattie, Tagart and Barton 1982). Preliminary records for Washington Department of Fisheries Minor Statistical Area 13 landing statistics during 1980-81 were kindly provided by M. G. Pedersen, WDF.

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[1]Pacific Marine Fisheries Commission, Portland, Oregon, USA.

[2]A minor amount of trawl-caught groundfish has been landed in the State of Oregon from Area 3C which is included in the PMFC Data Series. Oregon landings are not reported by minor statistical area.

A detailed description of the Option-2 method for allotting effort in a multi-species fishery has been submitted for publication. A brief description, in Stocker (1981, p. 69) is included here:

> Briefly described, the method involves arranging all-species effort and individual species' landings by depth interval in area-time cells. In each area-time cell, each species is allotted the all-species effort expended in the depth intervals containing the rank-1 (largest) and rank-2 (second-largest) landings of that species. For Pacific cod, and co-habitants, depth intervals were in 10-fm units, and area-time cells were fishing ground-quarter-year. LPUE (landing/h trawled) was calculated by dividing Option-2 landings by Option-2 effort. Estimated total effort ($\hat{E}$) is:
>
> $$\hat{E} = \frac{L}{\ell} e,$$
>
> where L = total landings
> ℓ = option-2 landings
> e = option-2 effort.

Option-2 values for total all-species effort and total landings for individual species are calculated by multiplying the quotient of total landings ÷ total interviewed landings by the rank 1+2 interviewed effort (or landing).

A modification of the Option-2 method was necessary for the data from Area 3C-N because of the heterogeneous fishery, described earlier. Thus "all-species" was replaced with "selected all-species", comprised of the three important shelf species--Pacific cod, lingcod, and petrale sole. The single exception to this procedure was for January-March (Quarter I), where petrale sole was deleted, because the mature specimens had migrated down the continental slope to spawn.

AGE COMPOSITION

The length-frequency samples consisted of approximately 100-300 fish each, and were collected by port liaison officers from Canadian trawl landings. Although samples in later years sometimes included data by sex, the sexes were combined for consistency with earlier years. There is little evidence of an appreciable difference in mean length at age by sex for the important age-classes. All cod were measured to the nearest centimeter of fork length.

METHODS

Age compositions were derived using a computer program, modified for use with Pacific cod length-frequency data by Foucher and Fournier (1982) from the generalized method of Schnute and Fournier (1980).

Samples were grouped by month and ground. Two exceptions were data from January-March 1974 and 1975 from Amphitrite Bank. In these cases the size composition varied appreciably among weeks and there were sufficient samples available to group by week. In other cases, samples from two or more grounds in the same month were combined where they were similar, because larger samples were more readily converted to age composition. Resulting age compositions were then assigned to all grounds involved.

Age composition, in numbers landed by age (N_i), were computed for each time period as follows:

$$N_i = (W/w)\ (n)(p_i)$$

where W = Canada-U.S. landings (t)
w = sample weight (t)
n = numbers sampled, and
p_i = proportion of fish at age i.

The weekly or monthly N_i's were then summed by quarter-year.

The numbers landed by quarter-year from representative grounds were then extrapolated by the quotient of Canada-U.S. landings from 3C-N ÷ Canada-U.S. landings from the representative grounds. In this way, the total number of removals of Pacific cod, by age, by year, from Area 3C-N is calculated for each quarter-year. In two cases, ground/quarter-year units which were deemed representative on the basis of landings did not have their age compositions computed directly. For Clo-oose/Quarter I, the age composition calculated for Amphitrite/Quarter I was used. In years where there were samples from both grounds, the length-frequencies were frequently quite similar. Likewise, for Big Bank/Quarter IV, Big Bank/Quarter III age compositions were utilized.

As a final calculation, the numbers landed by quarter from Area 3C were summed for Quarters II-IV of each year and Quarter I of the following year to produce the total numbers landed for the cod "years" of April-March 1956-57 to 1981-82.

Since there were few length-frequency samples collected during 1956-64 in Quarter I, no age compositions were calculated. Numbers landed for each of these cod "years" ($\hat{N}_{II-I}$) were estimated by the following formula:

$$\hat{N}_{II-I} = \frac{L_{II-I}}{L_{II-IV}} (N_{II-IV}),$$

where L_{II-I} = Canada-U.S. Pacific cod landings (t), April-March.
L^{II-IV} = Canada-U.S. Pacific cod landings (t), April-December.
N^{II-IV}_{II-IV} = Canada-U.S. Pacific cod landings (numbers), April-December.

Age composition for Quarter I, 1956-64, was assumed to the same as that for the preceding quarters II-IV.

RESULTS

LANDING STATISTICS

Pacific cod landings from Area 3C-S were not substantial in any quarter-year until 1975 (Table 1). Hence, for 1956-62, landing statistics for Area 3C as a whole were incorporated in the analysis.

Representative trawling grounds in Area 3C-N for each quarter-year, based on cumulative landings in Table 2 were: Amphitrite Bank and Clo-oose Ground in Quarter I; Amphitrite Bank, Clo-oose Ground, Big Bank, and Swiftsure Bank, in Quarter II; Big Bank and Swiftsure Bank in Quarter III; and Big Bank in Quarter IV. In Quarter I, Big Bank was eliminated because 98.7% of the 1963-81 cumulative landings originated from 3 yr--1965 (638 t), 1966 (370 t), and 1972 (254 t). In Quarter IV, Swiftsure Bank was eliminated, because 62.1% of the 1963-81 cumulative landings originated from 3 yr--1972 (50 t), 1973 (48 t), and 1975 (177 t). Minor Statistical Area 24 was rejected in all quarter-years because of relatively small cumulative landings--never more than 8% of total.

Representative quarter-years, based on 1963-81 cumulative landings, were I, II, and III, which together accounted for 95% of the total landings (Fig. 3, Table 4).

Use of Pacific cod, lingcod, and petrale sole together as "selected all-species" is justified by the fact that these three species accounted for 71-96% of the all-species landings from the important grounds in Area 3C-N, by quarter-year (Table 4).

Landing statistics for Pacific cod in Quarters I-IV, respectively, are contained in Tables 5-8. For Quarter I, the Option-2 method was employed (all the all-species effort was applied to cod) because cod comprised a substantial portion ($\geq$80%) of the all-species landings (see Table 4).

Landing statistics for the cod "year", April-March, are shown in Table 9. Annual LPUEs are based on April-September only. January-March was eliminated because the fishery occurred over a short time period (see Fig. 3); employed new, more efficient trawling techniques not applicable to other

quarter-years; and was restricted by regulations during 1978-82. October-December was eliminated because landings were small and irregular.

AGE COMPOSITION

Table 10 provides an inventory of cod sampled during 1956-82 by ground and quarter-year. A total of 92,297 cod lengths were included.

The age composition for Clo-oose/Quarter I is the same as that for Amphitrite/Quarter I, and for Big Bank/Quarter IV it is the same as for Big Bank/Quarter III.

Calculated age compositions (%) by year and quarter, of Pacific cod landed in British Columbia are contained in Appendix Tables 1-2 for Amphitrite Bank; 3-4 for Big Bank; 5 for Clo-oose Ground; and 6-7 for Swiftsure Bank. The total annual removals of Pacific cod from Area 3C-N by age class are contained in Tables 11-14 for Quarters I-IV, respectively. Total removals by age, by year, summed from Quarter II through Quarter I of the following year are contained in Table 15.

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Table 1. Canada-U.S. landings (t) of Pacific cod from Areas 3C and 3C-S, by quarter-year, 1963-78.

	Jan-Mar		Apr-Jun		Jul-Sep		Oct-Dec	
Year	3C	3C-S	3C	3C-S	3C	3C-S	3C	3C-S
1963	299	2	710	12	164	3	22	1
1964	237	-	693	13	167	2	45	1
1965	929	6	930	9	562	1	113	5
1966	826	2	917	10	850	1	52	-
1967	924	3	491	3	158	-	79	3
1968	801	4	260	5	42	1	69	2
1969	517	-	296	4	86	1	62	3
1970	357	-	305	21	240	1	64	1
1971	838	-	1,476	15	513	3	250	1
1972	2,379	-	2,189	31	724	6	196	1
1973	2,463	-	638	29	387	16	108	-
1974	1,805	-	792	13	603	30	165	1
1975	2,145	4	1,018	149	950	547	355	12
1976	1,711	2	1,482	182	608	150	115	5
1977	1,425	106	972	142	1,105	494	91	8
1978	692	9	983	215	679	539	143	68

Table 2. Cumulative Canada-U.S. landings (t) of Pacific cod from Area 3C-N, by ground by quarter-year, 1963-81.

Ground		Total	Quarter-year Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Amphitrite Bank	(t)	20,175	15,773	4,167	406	40
	%	47	84	27	6	2
Big Bank	(t)	11,218	1,279	4,378	4,268	1,293
	%	26	7	28	63	64
Swiftsure Bank	(t)	5,406	201	3,993	769	443
	%	13	1	26	11	22
Clo-oose Ground	(t)	3,362	1,357	1,683	277	45
	%	8	7	11	4	2
MSA 24	(t)	1,410	98	629	523	160
	%	3	1	4	8	8
Other	(t)	1,313	23	699	560	31
	%	3	T	4	8	2
Total	(t)	42,884	18,731	15,549	6,803	2,012
	%	100	100	100	100	100

Table 3. Canada-U.S. total, and Canada interviewed, landings (t) of Pacific cod by quarter-year from Areas 3C (1956-62) and 3C-N (1963-81).

	Jan-Mar		Apr-Jun		Jul-Sep		Oct-Dec	
Year	Total	Interv.	Total	Interv.	Total	Interv.	Total	Interv.
1956	19	11	730	308	170	68	228	75
1957	40	-	1,075	436	391	127	76	32
1958	57	15	408	147	165	61	133	103
1959	14	11	375	139	148	68	136	34
1960	18	2	321	77	167	62	84	18
1961	2	-	242	113	103	33	43	27
1962	97	9	286	98	156	70	24	15
1963	297	72	698	385	161	44	21	15
1964	237	227	680	486	165	87	44	35
1965	923	232	921	328	561	183	108	81
1966	824	414	907	619	849	373	57	43
1967	921	329	488	313	158	126	76	48
1968	797	358	255	74	41	32	67	49
1969	517	303	292	147	85	55	59	59
1970	357	303	284	240	239	149	63	58
1971	838	429	1,461	959	510	412	249	242
1972	2,379	1,431	2,158	1,802	718	627	195	156
1973	2,463	1,205	609	479	371	280	108	100
1974	1,805	1,139	779	593	573	344	164	131
1975	2,141	1,378	869	551	403	322	343	262
1976	1,709	1,243	1,300	446	458	266	110	40
1977	1,319	994	830	288	611	518	83	52
1978	683	527	768	497	140	65	75	56
1979	303	274	916	674	354	269	107	99
1980	1	-	595	415	322	267	59	52
1981	5	1	741	538	85	58	24	10
1982[a]	601	394	-	-	-	-	-	-

[a]Quarter I data provisional, Quarters II-IV not available.

Table 4. Cumulative Canada interviewed landings (t) of all-species and selected species from selected grounds, in Area 3C-N, by quarter-year, 1956-80.

Ground	All-species	Pacific cod	Lingcod	Petrale sole	% selected species
		January-March			
Amphitrite	9,644	9,164	86	(1)[a]	96
Clo-oose	1,473	1,180	5	(-)	80
		April-June			
Amphitrite	4,523	3,222	477	74	83
Big Bank	7,571	3,004	2,436	468	78
Clo-oose	2,449	1,540	161	33	71
Swiftsure	3,855	2,255	903	251	88
		July-September			
Big Bank	13,394	3,047	4,644	1,802	71
Swiftsure	2,085	567	672	250	71
		October-December			
Big Bank	3,576	1,222	825	530	72

[a]Not included as "selected species".

Table 5. Canada-U.S. landing statistics (Option-2) for Pacific cod during January-March from Areas 3C(1956-62) and 3C-N (1963-81).

Year	Total landings (t)			Total effort (h)			LPUE[a] (kg/h)
	3C-N	Amphitrite	Clo-oose	Amphitrite	Clo-oose	3C-N[b]	
1956	19	2	7	95	57	361	59
1957	40	-	-	3	4	-	-
1958	57	15	13	9	25	102	824
1959	14	13	-	14	-	16	929
1960	18	-	-	27	-	-	-
1961	2	-	-	-	-	-	-
1962	97	86	-	45	6	381	1,686
1963	297	154	112	(967)[c]	180	-	-
1964	237	45	185	127	530	677	350
1965	923	182	97	(4,742)[c]	363	-	-
1966	824	161	163	551	415	2,457	335
1967	921	637	278	2,326	389	2,733	337
1968	797	727	65	2,455	272	2,744	290
1969	517	514	3	1,462	25	1,487	348
1970	357	297	58	1,048	205	1,253	283
1971	838	784	36	1,660	126	1,825	459
1972	2,379	1,837	183	2,337	184	2,969	801
1973	2,463	2,347	112	1,917	141	2,061	1,195
1974	1,805	1,801	2	2,184	31	2,217	814
1975	2,141	2,097	36	3,115	84	3,211	667
1976	1,709	1,699	7	2,228	22	2,254	758
1977[d]	1,319	1,306	9	1,822	20	1,848	714
1978[d]	683	671	11	1,215	35	1,252	546
1979[d]	303	303	-	454	3	457	663
1980[d]	1	-	-	-	1	-	-
1981[d]	5	-	-	-	-	-	-
1982[d]	601	595	-	-	-	-	-

[a] $\text{LPUE} = \frac{\text{AM + CL Landings}}{\text{AM + CL Effort}}$

[b] $\text{3C-N Effort} = \frac{\text{3C-N Landings}}{\text{AM + CL Landings}} \text{ (AM + CL Effort)}$

[c] Anomalous values, due to large extrapolation values. See Fig.3.

[d] Closed to trawling for conservation purposes:
1978 February 22-April 3
1979 February 1-March 31 (shallower than 100 fm)
1980 January 1-March 31 (shallower than 100 fm)
1981 January 1-March 31 (shallower than 100 fm), except MSA 24
1982 January 1-31; March 13-31 (shallower than 100 fm).

Table 6. Canada-U.S. landing statistics (Option-2) for Pacific cod during April-June from Areas 3C (1956-62) and 3C-N (1963-81).

	Total landings (t)					Total effort (h)					
Year	3C-N	Amphi-trite	Big Bank	Clo-oose	Swift-sure	Amphi-trite	Big Bank	Clo-oose	Swift-sure	3C-N[b]	LPUE[a] (kg/h)
1956	730	533	92	41	12	1,237	1,001	192	291	2,930	249
1957	1,075	902	44	27	62	1,541	788	106	694	3,250	331
1958	408	278	58	13	53	707	100	52	283	1,159	352
1959	375	210	8	30	108	855	769	116	789	2,664	141
1960	321	104	25	60	50	1,022	1,073	150	632	3,193	83
1961	242	139	15	54	4	2,226	1,464	119	1,158	5,670	43
1962	286	152	15	64	6	664	341	241	682	2,327	123
1963	698	211	7	258	218	830	81	635	715	2,274	307
1964	680	264	102	70	241	1,040	303	317	617	2,287	297
1965	921	374	185	263	57	1,480	929	698	772	4,064	227
1966	907	398	270	245	33	1,252	1,639	722	558	4,270	212
1967	488	290	66	111	20	1,683	592	420	261	2,962	165
1968	255	157	38	39	21	693	239	244	495	1,671	153
1969	292	183	83	24	-	951	1,091	151	-	2,208	132
1970	284	165	73	39	4	1,059	282	251	90	1,700	167
1971	1,461	257	675	243	118	876	1,151	544	193	3,123	468
1972	2,158	430	927	275	288	1,560	1,376	604	426	4,458	484
1973	609	208	177	58	164	538	496	277	212	1,528	399
1974	779	22	259	27	464	164	1,190	115	488	1,975	394
1975	869	44	361	13	407	192	1,396	53	509	2,265	384
1976	1,300	254	383	3	517	740	1,851	202	799	4,036	322
1977	830	158	205	12	343	617	1,527	39	430	3,021	275
1978	768	289	132	-	179	604	1,208	-	290	2,691	285
1979	916	91	247	3	378	477	1,012	18	399	2,412	377
1980	595	272	147	-	142	1,236	962	-	336	2,688	221
1981	741	160	40	-	399	751	884	-	796	3,011	246

[a] $\text{LPUE} = \frac{\text{AM + BB+ CL+SS Landings}}{\text{AM + BB + CL + SS Effort}}$

[b] $\text{3C-N Total Effort} = \frac{\text{3C-N Landings}}{\text{AM + BB + CL + SS Landings}}$ (AM + BB + CL + SS Landings)

Table 7. Canada-U.S. landing statistics (Option-2) for Pacific cod during July-September from Areas 3C (1956-62) and 3C-N (1963-81).

Year	Total landings (t)			Total effort (h)			LPUE[a] (kg/h)
	3C-N	Big Bank	Swift-sure	Big Bank	Swift-sure	3C-N[b]	
1956	170	78	48	526	827	1,825	93
1957	391	314	-	3,066	-	3,818	102
1958	165	154	-	2,761	-	2,958	56
1959	148	100	4	2,465	85	3,629	41
1960	167	105	-	1,626	-	2,586	65
1961	103	22	-	1,490	-	6,976	15
1962	156	58	-	2,185	-	5,877	27
1963	161	136	-	1,703	-	2,016	80
1964	165	25	77	152	753	1,464	113
1965	561	426	11	2,047	754	3,596	156
1966	849	396	T[c]	1,753	18	3,797	224
1967	158	72	-	775	-	1,701	93
1968	41	38	T	764	52	880	47
1969	85	80	-	1,666	-	1,770	48
1970	239	200	T	1,808	23	2,188	109
1971	510	422	16	1,012	126	1,325	385
1972	718	574	45	1,563	53	1,874	383
1973	371	201	143	1,304	118	1,534	242
1974	573	356	135	1,543	162	1,990	288
1975	403	244	70	2,169	249	3,103	130
1976	458	408	19	3,232	87	3,560	129
1977	611	145	-	1,182	-	4,981	123
1978	140	88	T	572	6	913	152
1979	354	286	33	1,050	29	1,201	296
1980	322	112	205	878	289	1,185	272
1981	85	62	15	610	34	719	120

[a] $\text{LPUE} = \frac{\text{BB + SS Landings}}{\text{BB + SS Effort}}$

[b] $\text{3C-N Total Effort} = \frac{\text{3C-N Landings}}{\text{BB + SS Landings}}$ (BB + SS Effort)

[c] T = Trace.

Table 8. Canada-U.S. landing statistics (Option-2) for Pacific cod during October-December from Areas 3C (1956-62) and 3C-N (1963-81).

Year	Total landings (t)		Total effort (h)		LPUE[a] (kg/h)
	3C-N	Big Bank	Big Bank	3C-N[b]	
1956	228	225	2,885	2,923	78
1957	76	74	2,200	2,259	34
1958	133	70	587	1,115	119
1959	136	92	(5,286)[c]	-	-
1960	84	33	(2,846)[c]	-	-
1961	43	27	1,539	2,451	18
1962	28	17	631	1,039	27
1963	21	8	184	483	43
1964	44	35	161	202	217
1965	108	108	365	365	296
1966	57	4	(213)[c]	-	-
1967	76	68	634	709	107
1968	67	49	841	1,150	58
1969	59	23	172	441	134
1970	63	34	126	233	270
1971	249	243	430	441	565
1972	195	141	573	792	246
1973	108	42	167	429	251
1974	164	131	402	503	326
1975	343	118	473	1,375	249
1976	110	107	1,213	1,247	88
1977	83	22	277	1,045	79
1978	75	25	80	240	313
1979	107	88	187	219	471
1980	59	25	82	197	305
1981	24	22	309	337	71

[a] $\text{LPUE} = \frac{\text{BB Landing}}{\text{BB Effort}}$

[b] $\text{3C-N Total Effort} = \frac{\text{3C-N Landings}}{\text{BB landings}} \text{ (BB Effort)}$

[c] Extrapolation ratio too large.

Table 9. Canada-U.S. landing statistics (Option-2) for Pacific cod during April-March from Areas 3C (1956-62) and 3C-N (1963-81).

Year	Equivalent effort (h)[b]	Landings (t)		LPUE[a] (kg/h)
		Can.-U.S. total	Canada interv.	
1956-57	6,180	1,168	451	189
1957-58	7,725	1,599	610	207
1958-59	5,180	720	322	139
1959-60	8,157	677	243	83
1960-61	6,833	574	157	84
1961-62	(17,963)[c]	485	182	(27)[c]
1962-63	(14,204)[c]	767	255	(54)[c]
1963-64	5,585	1,117	671	200
1964-65	8,053	1,812	840	225
1965-66	12,508	2,414	1,006	193
1966-67	12,541	2,734	1,364	218
1967-68	10,928	1,519	845	139
1968-69	7,586	880	458	116
1969-70	8,347	793	565	95
1970-71	10,548	1,424	875	135
1971-72	10,381	4,599	3,044	443
1972-73	12,189	5,534	3,790	454
1973-74	9,041	2,893	1,998	320
1974-75	10,724	3,657	2,446	341
1975-76	14,025	3,324	2,378	237
1976-77	13,797	3,187	1,746	231
1977-78	12,261	2,207	1,395	180
1978-79	5,103	1,286	892	252
1979-80	3,937	1,378	1,042	350
1980-81	4,139	981	735	237
1981-82	6,566	1,451	1,000	221

[a] LPUE for April-September.

[b] Equivalent effort = Canada-U.S. total landings (April-March) ÷ LPUE (April-September).

[c] Anomalous value.

Table 10. Numbers of Pacific cod sampled by ground and quarter-year, 1956-81.

Ground	Quarter-year	Nos. sampled
Amphitrite	Jan-Mar [a]	21,988
	Apr-Jun	15,035
Big Bank	Apr-Jun	9,741
	Jul-Sep	21,902
Clo-oose	Apr-Jun	13,944
Swiftsure	Apr-Jun	6,944
	Jul-Sep	2,743
Total		92,297

[a] 1965-82.

Table 11. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during January-March from Area 3C-N(1965-82).

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9
1965	923	(5092)[a]	-	-	229506	102919	30049	10514	2627	-	-
1966	824	2457	-	24969	214192	55511	21572	1534	2174	702	257
1967	921	2733	-	24156	200668	86467	17917	13783	1992	1136	-
1968	797	2744	-	13054	135857	74223	36764	11441	4971	734	-
1969	517	1487	-	4219	92304	39748	21358	13743	3341	2100	-
1970	357	1253	-	17263	49438	48900	14503	3135	994	321	-
1971	838	1825	-	58920	199459	58368	25141	6045	3679	1530	-
1972	2379	2969	-	103647	539174	179580	58490	10234	3801	3658	-
1973	2463	2061	-	48000	395683	232848	82199	26417	3730	2421	-
1974	1805	2217	-	20018	138338	258723	102303	27583	12700	2823	901
1975	2141	3211	-	17101	489645	149922	77915	37460	5903	3688	452
1976	1709	2254	-	12997	321225	230194	79877	8441	3742	2021	391
1977	1319	1848	-	33875	168112	163408	65477	20430	6884	1033	-
1978	683	1252	-	960	118987	66584	40623	2403	8653	960	1201
1979	303	457	-	2958	26505	34318	18621	1390	3414	435	585
1980[b]	1	-	-	-	-	-	-	-	-	-	-
1981[b]	5	-	-	-	-	-	-	-	-	-	-
1982[c]	601	677	-	10874	95387	78170	33931	11785	4305	1512	946

[a] Anomalous value. Extrapolation ratio deemed too large.
[b] Area 3C closed inside 100 fms. No samples available to estimate age composition.
[c] Data provisional.

Table 12. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed during April-June from Areas 3C(1956-62) and 3C-N(1963-81).

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9
1956	730	2930	-	50214	121568	74038	29417	4450	2319	1505	191
1957	1075	3250	-	186163	145979	67192	38641	9090	1730	864	432
1958	408	1159	-	7714	122182	26023	14342	1116	1127	-	-
1959	375	2664	-	6450	57171	38068	9660	1596	886	-	332
1960	321	3193	-	1119	56763	38651	12577	4294	-	-	-
1961	242	5670	-	4515	25992	43043	16244	928	1293	-	-
1962	286	2327	-	104796	23602	18409	8180	2201	156	-	-
1963	698	2274	-	173141	104318	42480	8312	1176	1276	-	-
1964	680	2287	-	108036	49502	70886	35217	15134	2111	1121	-
1965	921	4064	-	126728	160700	67698	21026	7253	670	759	-
1966	907	4270	-	157144	145005	66723	14081	6175	1234	-	-
1967	488	2962	-	5781	126399	54168	6578	5585	710	-	15
1968	255	1671	-	18036	57275	16104	1884	1508	-	-	-
1969	292	2208	-	42553	47267	22488	8418	853	2172	389	-
1970	284	1700	-	86141	50758	21920	4652	1011	136	43	-
1971	1461	3123	1029	454917	235934	37909	7746	2984	733	599	-
1972	2158	4458	-	804710	262733	83484	14365	2762	3273	-	-
1973	609	1528	157	51141	134343	40062	16144	2570	711	-	-
1974	779	1975	-	220209	35354	85944	31324	4754	1480	2827	53
1975	869	2265	-	132723	227121	32130	14228	5454	1428	-	-
1976	1300	4036	-	78838	264646	147608	19287	4549	1243	2513	-
1977	830	3021	-	79989	116592	94561	35586	6778	2710	2710	-
1978	768	2691	-	51443	192031	65869	14977	6607	1841	151	-
1979	916	2412	-	116955	157814	76104	35260	5304	902	992	395
1980	595	2688	-	119257	72945	50202	25784	10530	-	-	-
1981	741	3011	-	42065	261318	30390	5645	8645	4246	-	-

Table 13. Canada-U.S. Pacific cod landings(t), effort(h) and age frequency (nos. landed) during July-September, for Areas 3C(1956-62) and 3C-N(1963-81).

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9
1956	170	1825	-	6517	14754	25503	10061	-	340	-	-
1957	391	3818	-	-	63122	42313	24687	6413	965	603	276
1958	165	2958	-	1820	54829	7765	1339	1380	153	-	-
1959	148	3629	-	5448	18941	23549	4685	145	206	-	-
1960	167	2586	-	1805	43051	18017	4111	264	84	-	-
1961	103	(6976)[a]	-	4101	3914	18400	9771	1114	-	-	-
1962	156	(5877)[a]	-	51356	16544	6229	1409	264	342	-	-
1963	161	2016	-	59095	14611	6838	1939	331	-	-	-
1964	165	1464	-	1865	15690	18907	12108	4284	178	36	71
1965	561	3596	-	38753	119652	50208	8696	1556	1166	-	-
1966	849	3797	-	650	185642	118311	27400	16851	2110	-	-
1967	158	1701	-	10564	19335	15894	1788	871	-	-	-
1968	41	880	-	8359	5843	2875	610	287	-	-	-
1969	85	1770	-	12933	17100	6819	1645	400	176	-	-
1970	239	2188	72	71436	23149	14723	4221	380	382	81	-
1971	510	1325	6234	164664	62662	10458	2013	708	686	151	-
1972	718	1874	1521	196187	109803	25537	8792	1863	318	-	-
1973	371	1534	138	43026	48719	43699	4416	8067	1002	349	99
1974	573	1990	-	182796	39242	44227	15026	6456	1064	659	-
1975	403	3103	-	86615	74726	15673	5334	3356	409	445	-
1976	458	3560	-	58541	92356	48864	11883	1639	976	-	-
1977	611	4981	-	97490	108792	47822	1837	6826	-	-	-
1978	140	913	-	-	-	-	-	-	-	-	-
1979	354	1201	676	56864	55380	28855	8844	2840	485	-	-
1980	322	1185	2758	46621	32793	29674	10017	6385	1322	162	404
1981	85	719	2782	19591	10933	5632	1824	389	347	-	-

[a] Anomalous value. Extrapolation ratio deemed too large.
[b] No samples available to estimate age composition.

Table 14. Canada-U.S. Pacific cod landings(t), effort(h) and age frequency (nos. landed) during October-December from Areas 3C(1956-62) and 3C-N(1963-81).

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9
1956	228	2923	-	8743	19788	34208	13499	-	460	-	-
1957	76	2259	-	-	12276	8238	4792	1238	188	107	53
1958	133	1115	-	1465	44236	6242	1085	1138	108	-	-
1959	136	(7814) [a]	-	5029	17877	22110	4432	149	198	-	-
1960	84	(7244) [a]	-	914	21664	9085	2067	135	33	-	-
1961	43	2451	-	1714	1636	7683	4082	467	-	-	-
1962	24	1039	-	8338	2684	1014	234	37	49	-	-
1963	21	483	-	7804	1922	906	249	42	-	-	-
1964	44	202	-	-	13052	4093	1539	93	-	-	-
1965	108	365	-	7596	23481	9841	1683	302	215	-	-
1966	57	(3035) [a]	-	43	12070	7681	1767	1083	128	-	-
1967	76	709	-	5082	9302	7647	862	419	-	-	-
1968	67	115	-	13660	9547	4700	998	469	-	-	-
1969	59	441	-	9004	11915	4761	1142	272	136	-	-
1970	63	233	30	18765	6074	3878	1112	89	89	30	-
1971	249	441	2931	78202	29546	4924	938	351	351	117	-
1972	195	792	378	53329	30676	6890	2453	472	94	-	-
1973	108	429	46	20780	15951	8586	1268	1803	339	-	-
1974	164	503	-	49737	12578	13564	4193	1726	247	247	-
1975	343	1375	-	85032	53961	16842	3758	3433	-	488	-
1976	110	1247	-	13843	21855	11612	2788	405	253	-	-
1977 [b]	83	1045	-	13242	14778	6497	249	928	-	-	-
1978	75	240	-	-	-	-	-	-	-	-	-
1979	107	219	187	17495	16697	8677	2766	890	140	-	-
1980	59	197	1430	8536	8536	3731	791	2096	434	-	-
1981	24	337	975	6500	1704	1810	623	47	94	-	-

[a] Anomalous value. Extrapolation ratio deemed too large.
[b] No samples available to estimate age composition.

Table 15. Canada-U.S Pacific cod landings(t), effort(h), and age frequency (nos. landed) during April-March for Areas 3C(1956-62) and 3C-N(1963-81).

Year	C-US Land (t)	C-US Eff (h)	Age 1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9
1956-57	1168	6180	-	67796	161646	138492	54856	4608	3230	1558	198
1957-58	1599	7725	-	193045	229560	122095	70638	17360	2990	1632	789
1958-59	720	5180	-	11217	225634	40824	17098	3706	1416	-	-
1959-60	677	8157	-	17389	96556	86014	19290	1942	1325	-	341
1960-61	574	6833	-	3851	121903	65983	18821	4709	117	-	-
1961-62	485	(17963)	-	12912	39428	86408	37621	3136	1616	-	-
1962-63	767	(14204)	-	270738	70495	42221	16168	4118	900	-	-
1963-64	1117	5585	-	304687	153398	63750	13328	1966	1620	-	-
1964-65	1812	8053	-	339407	181163	123935	59378	22138	2289	1157	71
1965-66	2414	12508	24969	387269	359344	149319	32939	11285	2753	1016	-
1966-67	2734	12541	24156	358505	429184	210632	57031	26101	4608	-	-
1967-68	1519	10928	13054	157284	229259	114473	20669	11846	1444	-	15
1968-69	880	7586	4219	132359	112413	45037	17235	5605	2100	-	-
1969-70	793	8347	17263	113928	125182	48571	14340	2519	2805	389	-
1970-71	1424	10548	59022	375801	138349	65662	16030	5159	2137	154	-
1971-72	4599	10381	113841	1236957	507722	111781	20931	7844	5428	867	-
1972-73	5534	12189	49899	1449909	636060	198110	52027	8827	6106	-	-
1973-74	2893	9041	20359	253285	457736	194650	49411	25140	4875	1250	99
1974-75	3657	10724	17101	942387	237096	221650	88003	18839	6479	4185	53
1975-76	3324	14025	12997	625595	586002	144522	31761	15985	3858	1324	-
1976-77	3187	13797	33875	319334	542265	273561	54388	13477	3505	2513	-
1977-78	2207	12261	960	309708	306746	189503	40075	23185	3670	3911	-
1978-79	1286	5103	2958	77948	226349	84490	16367	10021	2276	736	-
1979-80	1378	3937	863	191314	229891	113636	46870	9034	1527	992	395
1980-81	981	4139	4188	174414	114274	83607	36592	19011	1756	162	404
1981-82	1451	6566	14631	163543	352125	71763	19877	13386	6199	946	-

[a]Equivalent effort - see Table 4.
[b]No age 1-2 fish in 1956-64 due to lack of Quarter I age compositions for these years.
[c]Anomalous value. Extrapolation ratio deemed too large.
[d]1982 Quarter I data provisional.

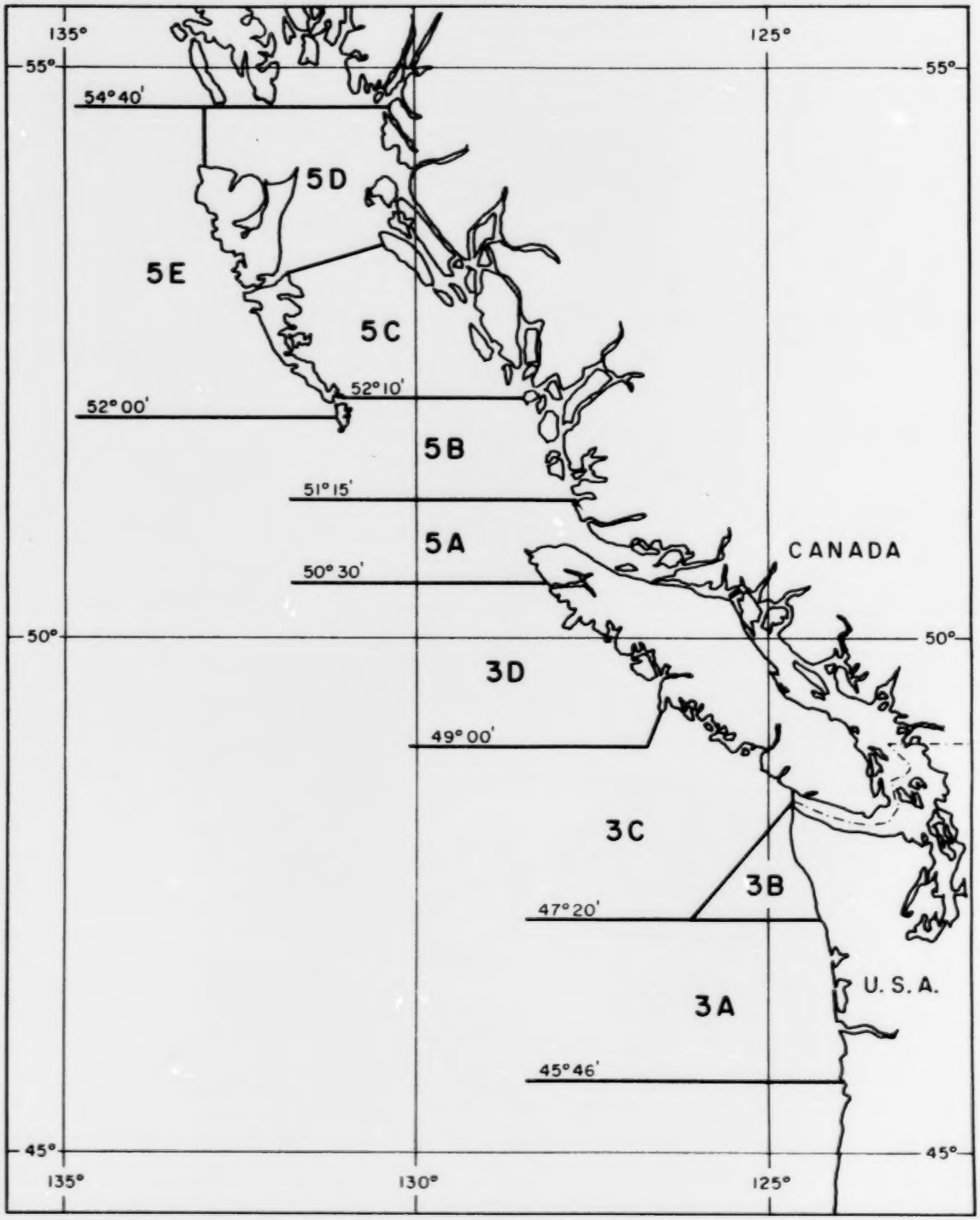

Fig. 1. International area for Canada-U.S. landings of groundfish.

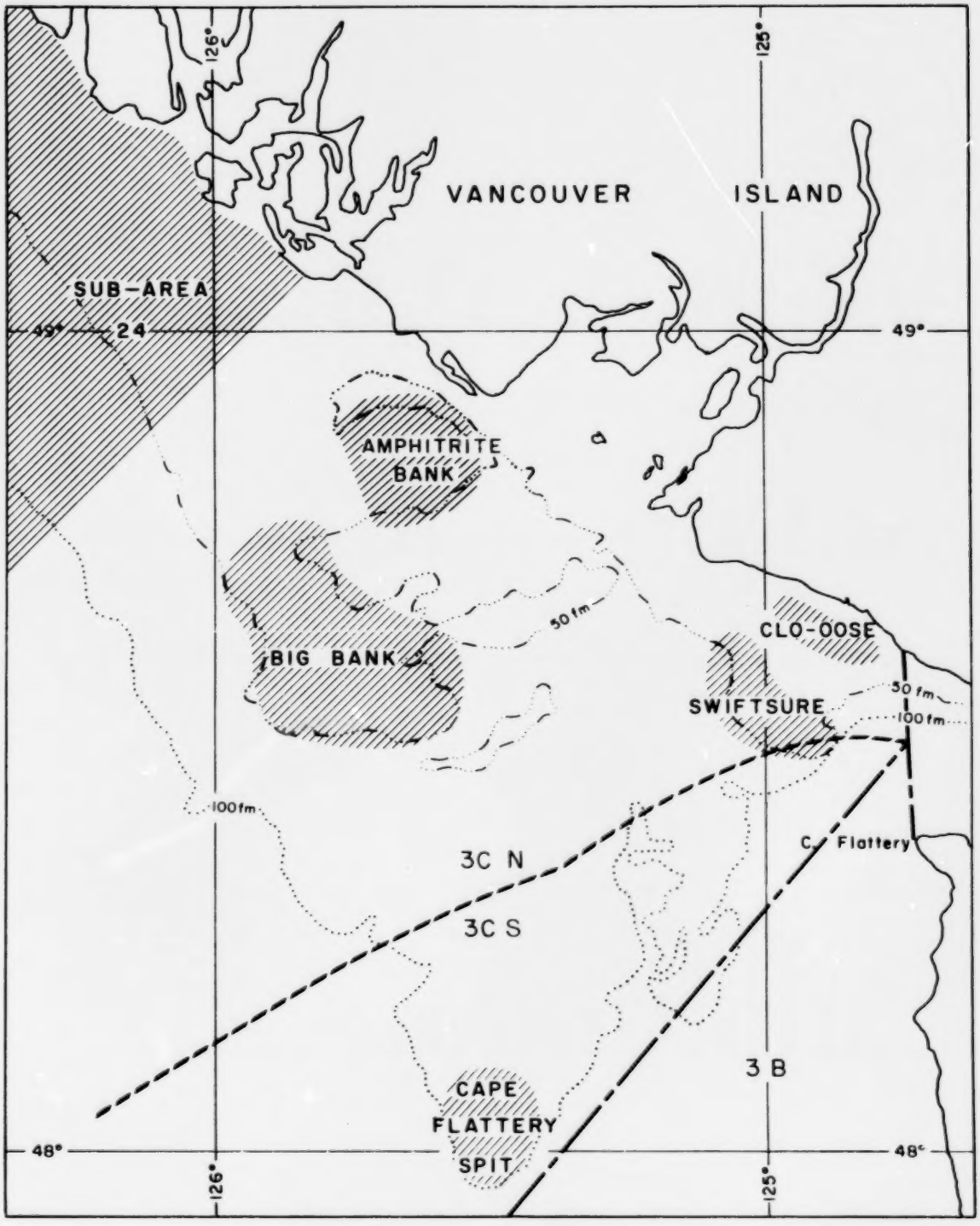

Fig. 2. Principal trawling grounds in International Area 3C.

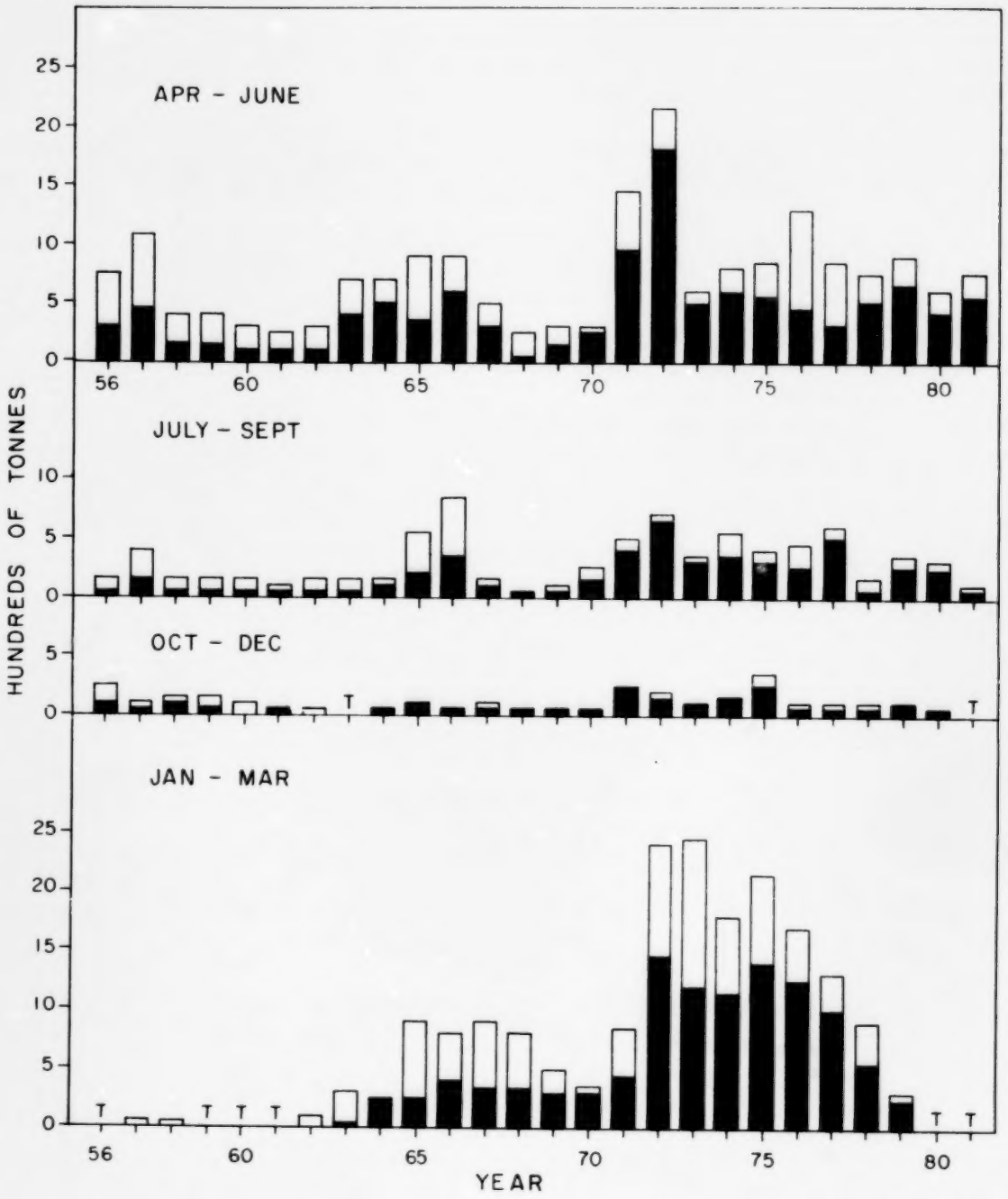

Fig. 3. Canada-U.S. total, and Canada interviewed (shaded areas), landings (t) of Pacific cod from Area 3C (1956-62) and Area 3C-N (1963-81), by quarter-year, 1956-81.

Appendix Table 1. Canada-U.S. Pacific cod landings(t) and effort(h), and age frequency (%) for Canadian landings, Amphitrite Bank, January-March, 1965-82.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1965	182	4742	-	-	61.1	27.4	8.0	2.8	0.7	-	-
1966	161	551	-	7.8	66.7	17.3	6.7	0.5	0.7	0.2	0.1
1967	637	2326	-	7.0	57.9	25.0	5.2	4.0	0.6	0.3	-
1968	727	2455	-	4.7	49.0	26.8	13.3	4.1	1.8	0.3	-
1969	514	1462	-	2.4	52.1	22.5	12.1	7.8	1.9	1.2	-
1970	297	1048	-	12.8	36.9	36.3	10.8	2.3	0.7	0.2	-
1971	784	1660	-	16.7	56.6	16.5	7.1	1.7	1.0	0.4	-
1972	1837	2337	-	11.5	60.1	20.0	6.5	1.1	0.4	0.4	-
1973	2347	1917	-	6.1	50.0	29.4	10.4	3.3	0.5	0.3	-
1974	1801	2184	-	3.6	24.6	45.7	18.2	4.9	2.3	0.5	0.2
1975	2097	3115	-	2.2	62.4	19.2	10.0	4.8	0.3	0.5	0.1
1976	1699	2228	-	2.0	48.7	34.9	12.1	1.3	0.6	0.3	0.1
1977	1306	1821	-	7.4	36.6	35.6	14.3	4.4	1.5	0.2	-
1978	671	1215	-	0.4	49.5	27.7	16.9	1.0	3.6	0.4	0.5
1979	303	454	-	3.4	30.0	38.8	21.1	1.6	3.9	0.5	0.7
1980 [a]	0	0	-	-	-	-	-	-	-	-	-
1981 [a]	0	0	-	-	-	-	-	-	-	-	-
1982 [b]	595	677	-	4.6	40.3	33.0	14.3	5.0	1.8	0.6	0.4

[a] No landings due to closure.
[b] 1982 data provisional.

Appendix Table 2. Canada-U.S. Pacific cod landings(t) and effort(h), and age frequency (%) for Canadian landings, Amphitrite Bank, April-June, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	533	1237	-	22.1	41.3	24.1	9.4	1.5	0.8	0.7	0.1[a]
1957	902	1541	-	41.6	32.2	14.7	8.7	2.1	0.4	0.2	0.1
1958	278	707	-	4.7	65.3	20.6	7.8	0.8	0.8	-	-
1959	210	855	-	5.6	50.5	33.1	8.3	1.4	0.8	-	0.3[a]
1960	104	1022	-	1.1	53.7	31.6	11.8	1.8	-	-	-
1961	139	2226	-	-	18.9	54.9	23.6	0.7	1.9	-	-
1962	152	664	-	66.6	15.0	11.7	5.2	1.4	0.1	-	-
1963	211	830	-	42.6	40.8	13.7	2.3	-	0.6	-	-
1964	264	1040	-	61.9	26.7	8.0	2.6	0.8	-	-	-
1965	374	1480	-	25.0	34.8	28.2	9.2	2.7	-	0.1[a]	-
1966	338	1252	-	12.7	60.3	21.6	3.9	0.9	0.6	-	-
1967	290	1683	-	2.4	55.6	33.3	5.0	3.5	0.2	-	-
1968	157	693	-	12.6	69.0	16.2	0.8	1.4	-	-	-
1969	183	951	-	19.4	48.7	20.8	7.9	0.8	1.9	0.5	-
1970	165	1059	-	54.8	31.5	12.1	1.3	0.3	-	-	-
1971	257	876	0.7	45.4	40.9	10.8	1.7	0.4	0.1[a]	-	-
1972	430	1560	-[a]	55.0	36.6	6.9	1.3	-	0.2[a]	-	-
1973	208	538	0.2[a]	14.5	44.3	33.1	6.9	0.7	0.3	-	-
1974	22	164	-	24.9	17.3	18.9	22.7	13.6	0.7	1.2	0.7
1975	44	192	-	26.3	57.0	13.2	3.5	-	-	-	-
1976	254	740	-	6.9	52.2	37.7	1.0	2.2	-	-	-
1977	158	617	-	23.6	34.4	27.9	10.5	2.0	0.8	0.8	-
1978	289	604	-	23.9	45.3	21.8	6.4	1.3	1.2	0.1	-
1979	91	477	-	22.8	49.9	19.9	6.1	0.4	0.3	0.6	-
1980	272	1236	-	41.5	32.5	15.2	6.3	4.5	-	-	-
1981	160	751	-	8.3	68.6	16.5	4.5	0.3	1.8	-	-

[a]Fish omitted during computer analysis.

Appendix Table 3. Canada-U.S. Pacific cod landings(t)and effort(h), and age frequency (%) for Canadian landings, Big Bank, April-June, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	92	1001	-	1.6	48.1	33.5	13.9	2.0	0.9	-	-
1957	44	788	-	35.3	38.3	20.7	5.7	-	-	-	-
1958	58	100	-	-	86.4	2.4	10.4	0.4	0.4	-	-
1959	8	769	-	7.4	35.4	41.7	14.1	1.4	-	-	-
1960	25	1073	-	1.1	53.7	31.6	11.8	1.8	-	-	-
1961	15	1464	-	-	18.9	54.9	23.6	0.7	1.9	-	-
1962	15	341	-	66.6	15.0	11.7	5.2	1.4	0.1	-	-
1963	7	81	-	56.3	27.8	12.5	2.6	0.5	0.3	-	-
1964	102	303	-	14.0	7.1	43.0	22.2	11.2	1.6	0.9	-
1965	185	929	-	38.6	46.7	10.0	2.8	1.3	0.3	0.3	-
1966	270	1639	-	51.6	26.8	14.5	5.2	1.5	0.4	-	-
1967	66	592	-	3.6	75.6	17.8	0.7	1.7	0.6	-	-
1968	38	239	-	52.6	15.2	21.1	8.5	2.6	-	-	-
1969	83	1091	-	59.3	20.2	13.6	4.9	0.5	1.5	-	-
1970	73	282	-	58.7	27.4	8.1	4.3	1.4	-	0.1	-
1971	675	1151	-	65.0	29.7	3.8	0.9	0.4	0.1	0.1	-
1972	927	1376	-	72.4	18.6	7.2	1.2	0.3	0.3	-	-
1973	177	496	-	37.1	44.9	13.9	3.0	1.1	-	-	-
1974	259	1190	-	52.5	13.7	23.4	6.7	2.0	0.6	1.1	-
1975	361	1396	-	16.2	76.6	3.0	2.9	1.2	0.1	-	-
1976	383	1851	-	22.4	51.9	18.3	6.0	0.6	0.3	0.5	-
1977	205	1527	-	23.6	34.4	27.9	10.5	2.0	0.8	0.8	-
1978	132	1208	-	1.5	72.5	24.5	1.5	-	-	-	-
1979	247	1012	-	43.8	29.9	15.7	9.3	0.7	0.1	0.5	-
1980	147	962	-	44.1	19.8	20.8	12.2	3.1	-	-	-
1981	40	884	-	13.2	76.1	5.9	0.6	3.2	1.0	-	-

Appendix Table 4. Canada-U.S. Pacific cod landings(t) and effort(h), and age frequency (%) for Canadian landings, Big Bank, July-September, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	78	526	-	11.4	25.8	44.6	17.6	-	0.6	-	-
1957	314	3066	-	-	45.7	30.6	17.8	4.6	0.7	0.4	0.2
1958	154	2761	-	2.7	81.5	11.5	2.0	2.1	0.2	-	-
1959	100	2465	-	10.1	35.9	44.4	8.9	0.3	0.4	-	-
1960	105	1626	-	2.7	63.9	26.8	6.1	0.4	0.1	-	-
1961	22	1490	-	11.0	10.5	49.3	26.2	3.0	-	-	-
1962	58	2185	-	67.5	21.7	8.2	1.9	0.3	0.4	-	-
1963	136	1703	-	71.4	17.6	8.3	2.3	0.4	-	-	-
1964	25	152	-	-	69.5	21.8	8.2	0.5	-	-	-
1965	426	2047	-	17.6	54.5	22.8	3.9	0.7	0.5	-	-
1966	396	1753	-	0.2	52.9	33.7	7.8	4.8	0.6	-	-
1967	72	775	-	21.8	39.9	32.8	3.7	1.8	-	-	-
1968	38	764	-	46.5	32.5	16.0	3.4	1.6	-	-	-
1969	80	1666	-	33.1	43.7	17.5	4.2	1.0	0.5	-	-
1970	197	1780	0.1[a]	62.4	20.2	12.9	3.7	0.3	0.3	0.1	-
1971	422	1012	2.5	66.6	25.2	4.2	0.8	0.3	0.3	0.1	-
1972	574	1563	0.4	56.6	32.5	7.3	2.6	0.5	0.1	-	-
1973	201	1304	0.1	42.6	32.7	17.6	2.6	3.7	0.7	-	-
1974	356	1543	-	60.4	15.3	16.5	5.1	2.1	0.3	0.3	-
1975	244	2169	-	52.0	33.0	10.3	2.3	2.1	-	0.3	-
1976	408	3232	-	27.3	43.0	22.9	5.5	0.8	0.5	-	-
1977	145	1182	-	37.1	41.4	18.2	0.7	2.6	-	-	-
1978[b]	88	572	-	-	-	-	-	-	-	-	-
1979	286	1050	0.4	37.4	35.6	18.5	5.9	1.9	0.3	-	-
1980	112	878	5.6	33.4	33.4	14.6	3.1	8.2	1.7	-	-
1981	62	610	8.3	55.3	14.5	15.4	5.3	0.4	0.8	-	-

[a] Fish omitted during computer analysis.
[b] No samples available to estimate age composition.

Appendix Table 5. Canada-U.S. Pacific cod landings(t) and effort(h), and age frequency (%) for Canadian landings, Clo-oose Ground, April-June, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	41	192	-	1.6	48.1	33.5	13.9	2.0	0.9	-	-
1957	27	106	-	41.6	32.2	14.7	8.7	2.1	0.4	0.2	0.1
1958	13	52	-	32.5	61.0	2.5	3.5	0.5	-	-	-
1959	30	116	-	5.6	50.5	33.1	8.3	1.4	0.8	-	0.3[a]
1960	60	150	-	0.7	40.3	40.7	9.2	9.1	-	-	-
1961	54	119	-	18.9	54.9	23.6	0.7	1.9	-	-	-
1962	64	241	-	66.6	15.0	11.7	5.2	1.4	0.1	-	-
1963	258	635	-	56.3	27.8	12.5	2.6	0.5	0.3	-	-
1964	70	317	-	38.8	22.1	23.9	14.3	0.5	0.4	-	-
1965	263	698	-	38.6	46.7	10.0	2.8	1.3	0.3	0.3	-
1966	245	722	-	62.6	18.8	14.0	2.2	2.4	-	-	-
1967	111	420	-	3.6	75.6	17.8	0.7	1.7	0.6	-	-
1968	39	244	-	12.6	69.2	16.2	0.6	1.4	-	-	-
1969	24	151	-	59.3	20.2	13.6	4.9	0.5	1.5	-	-
1970	39	251	-	30.0	33.9	27.6	7.2	0.7	0.6	-	-
1971	243	544	-	65.0	29.7	3.8	0.9	0.4	0.1	0.1	-
1972	275	604	-	72.4	18.6	7.2	1.2	0.3	0.3	-	-
1973	58	277	-	14.0	70.8	4.4	9.0	1.3	0.5	-	-
1974	27	115	-	87.2	9.7	2.3	0.3	0.5	-	-	-
1975	13	53	-	45.0	38.0	11.0	3.9	1.5	0.6	-	-
1976	3	202	-	12.8	49.8	33.1	3.0	0.4	0.3	0.6	-
1977	12	39	-	23.6	34.4	27.9	10.5	2.0	0.8	0.8	-
1978	0	0	-	-	-	-	-	-	-	-	-
1979	3	18	-	21.3	44.9	21.8	9.5	2.1	0.2	-	0.2
1980	0	0	-	-	-	-	-	-	-	-	-
1981	0	0	-	-	-	-	-	-	-	-	-

[a] Fish omitted during computer analysis.

Appendix Table 6. Canada_U.S. Pacific cod landings(t) and effort(h), and age frequency (%) for Canadian landings, Swiftsure Ground, April-June, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	12	291	-	1.6	48.1	33.5	13.9	2.0	0.9	-	-
1957	62	694	-	41.6	32.2	14.7	8.7	2.1	0.4	0.2	0.1
1958	53	283	-	-	86.4	2.4	10.4	0.4	0.4	-	-
1959	108	789	-	5.6	50.5	33.1	8.3	1.4	0.8	-	0.3 [a]
1960[b]	50	632	-	-	-	-	-	-	-	-	-
1961[b]	4	1158	-	-	-	-	-	-	-	-	-
1962[b]	6	682	-	-	-	-	-	-	-	-	-
1963	218	715	-	56.3	27.8	12.5	2.6	0.5	0.3	-	-
1964	241	617	-	14.0	7.1	43.0	22.2	11.2	1.6	0.9	-
1965	57	772	-	38.6	46.7	10.0	2.8	1.3	0.3	0.3	-
1966	33	558	-	51.6	26.8	14.5	5.2	1.5	0.4	-	-
1967	20	261	-	3.6	75.6	17.8	0.7	1.7	0.6	-	-
1968	21	495	-	12.6	69.2	16.2	0.6	1.4	-	-	-
1969	0	0	-	-	-	-	-	-	-	-	-
1970	4	90	-	30.0	33.9	27.6	7.2	0.7	0.6	-	-
1971	118	193	-	65.0	29.7	3.8	0.9	0.4	0.1	0.1	-
1972	288	426	-	72.4	18.6	7.2	1.2	0.3	0.3	-	-
1973	164	212	-	14.0	70.8	4.4	9.0	1.3	0.5	-	-
1974	464	488	-	58.9	6.6	23.9	9.2	0.5	0.3	0.6	-
1975	407	509	-	45.0	38.0	11.0	3.9	1.5	0.6	-	-
1976	517	799	-	12.8	49.7	33.0	3.0	0.5	0.3	0.7	-
1977	343	430	-	23.6	34.4	27.9	10.5	2.0	0.8	0.8	-
1978	179	290	-	13.0	65.1	13.8	3.8	4.3	-	-	-
1979	378	399	-	21.3	44.8	21.8	9.5	2.1	0.3	-	0.2
1980	142	336	-	44.1	19.8	20.8	12.2	3.1	-	-	-
1981	399	796	-	13.2	76.1	5.9	0.6	3.2	1.0	-	-

[a] Fish omitted during computer analysis.
[b] No samples available to estimate age composition.

Appendix Table 7. Canada-U.S. Pacific cod landings(t) and effort(h) and age frequency (%) for Canadian landings, Swiftsure Ground, July-September, 1956-81.

Year	Can.-U.S. Landings (t)	Can.-U.S. Effort (h)	Age 1	2	3	4	5	6	7	8	9
1956	48	827	-	11.4	25.8	44.6	17.6	-	0.6	-	-
1957	0	0	-	-	-	-	-	-	-	-	-
1958	0	0	-	-	-	-	-	-	-	-	-
1959	4	85	-	14.6	31.3	45.1	8.4	-	0.6	-	-
1960	0	0	-	-	-	-	-	-	-	-	-
1961	0	0	-	-	-	-	-	-	-	-	-
1962	0	0	-	-	-	-	-	-	-	-	-
1963	0	0	-	-	-	-	-	-	-	-	-
1964	77	753	-	5.2	10.3	42.2	29.8	11.7	0.5	0.1	0.2
1965	11	754	-	17.0	53.5	23.8	4.3	0.8	0.6	-	-
1966	T [a]	18	-	-	-	-	-	-	-	-	-
1967	0	0	-	-	-	-	-	-	-	-	-
1968	T	52	-	-	-	-	-	-	-	-	-
1969	0	0	-	-	-	-	-	-	-	-	-
1970	T	23	-	-	-	-	-	-	-	-	-
1971	16	126	3.6	60.8	28.0	5.2	1.7	0.5	0.2	-	-
1972	45	53	1.0	63.5	24.1	8.7	1.5	0.6	0.6	-	- [b]
1973	143	118	-	1.2	32.3	52.4	3.7	8.8	0.7	0.7	0.2
1974	135	162	-	70.1	8.9	12.2	5.5	2.7	0.5	0.1	-
1975	70	249	-	24.1	68.3	0.8	5.1	0.6	1.1	-	-
1976	19	87	-	27.8	44.2	21.7	5.5	0.4	0.4	-	-
1977	0	0	-	-	-	-	-	-	-	-	-
1978	T	6	-	-	-	-	-	-	-	-	-
1979	33	29	0.8	33.2	39.8	21.4	3.9	0.9	-	-	-
1980	205	289	-	37.3	20.2	27.8	10.5	2.9	0.6	0.2	0.5
1981	15	34	-	13.2	76.1	5.9	0.6	3.2	1.0	-	-

[a] T = trace landings (< 0.5 t), not sampled.
[b] Fish omitted during computer analysis.